Chapter Two - Understanding Your Stream and Watershed

WATERSHED APPROACH

Riparian areas are shaped by the dynamic forces of water flowing across the landscape. Flooding, for instance, is a natural and necessary component of riparian areas. Many riparian plant species such as cottonwood require floods to regenerate. Geomorphological characteristics of the steam valley such as floodplain level, drainage area, stream capacity, channel slope, and soils are some of the factors that influence the frequency, duration, and intensity of flooding (Leopold et al. 1964). Flooding, in turn, influences the size and structure of the stream channel and composition of the riparian vegetation (Hupp and Osterkamp 1996).

Healthy streams and riparian areas are naturally resilient which allows recovery from natural disturbances such as flooding (Florsheim and Coats 1997). Streambank stability is a function of a healthy riparian area. When a stream and riparian system is degraded, this resiliency to natural disturbances is diminished. Excessive flooding, erosion, and sedimentation will often increase. Degraded riparian areas are less effective for storing floodwaters. As more sediment is deposited, water quality is also diminished. High levels of sediment in a stream suffocate fish, fill in spawning gravels and pools, and kill aquatic insects (Platts and Rinne 1985).

As additional sediment is deposited in streams, the streambed may aggrade and become shallower, forcing water to spread out and cause bank erosion (Leopold 1994). Excessive bank erosion causes wider, shallower channels and lowers the water table. A shallower stream also has a lower dissolved oxygen content and a higher temperature, which supports less aquatic life.

..excessively eroding streambanks are only symptoms of an unhealthy stream, not the true cause of the problem.

In other streams, headcutting may occur, which is the cutting of the streambed to a lower bed elevation. As the streambed lowers, the water table also lowers. This causes riparian vegetation to die-off and be replaced with upland vegetation, which is less successful in stabilizing the streambank (Briggs 1996). In either case, headcutting or aggradation greatly diminishes the natural resiliency of riparian areas.

Riparian area health and streambank stability is simply a reflection of the conditions in the surrounding landscape. When studying your stream, it is important to keep in mind that extensive stretches of eroding streambanks are only symptoms of an unhealthy system and are not the true cause of the problems.

Consequently, to understand the factors that are affecting your stream, one must look at the whole watershed to gain an understanding of the big picture (Hunter 1990). A watershed is simply the area of land that drains into a particular stream. There are many factors that can contribute to an unhealthy watershed and riparian system. To adequately address these factors, an interdisciplinary approach is essential. Chapter 3 lists some of the professionals that should be consulted in determining the true source of the problems. In many cases, land management practices may be the primary source of problems.

PROPER LAND USE MANAGEMENT

Current and past land management practices in the watershed will affect runoff, streamflow and sediment load of a stream (Hunter 1990). This in turn influences the natural dynamics and health of stream and riparian areas. Common land uses in the Great Basin and Intermountain Region that can impact streams include agriculture, livestock grazing, timber harvest, road building, recreational activities, and urbanization (Briggs 1996; Platts and Rinne 1985; Schueler 1995).

The first step in any restoration process is to determine land management problems that created the unhealthy stream and riparian area. A change in management practices may be required to allow the stream to begin the healing process. In many instances, a change in land management practices is all that is necessary to restore the stream and riparian area to a healthy condition (Briggs et al. 1994; Hunter 1990; Kauffman et al. 1995). This type of restoration is often preferred because it is usually more cost-effective and will generally respond better to site conditions than a project that just relies on bioengineering techniques. However, carefully planned bioengineering techniques can be used in these situations to accelerate the restoration process. Where riparian areas are extremely degraded, bioengineering techniques may be necessary for restoration, in addition to a change in land management practices.

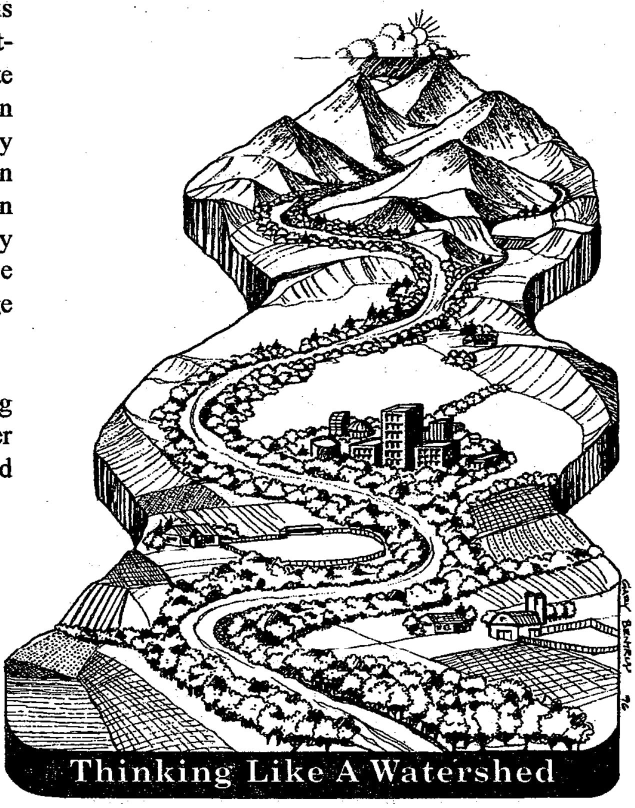
It should be kept in mind that bioengineering should not be viewed as a substitute for proper land use management. Without changes in land management, the success of bioengineering efforts will most likely be short term.

The following section discusses common land use practices in the region and suggests basic best management practices to minimize the impact of these uses. A best management practice (BMP) may be defined as a structural and non-structural method to control erosion, improve water quality, and protect wildlife habitat. It is important not to rely only on one or two BMP because these practices are much more effective when applied in systems. It should also be noted that the discussion of specific BMP measures under one land use type may also be applicable to another land use.

Additional references for proper land use management can be found in the Resources section of this guide.

"To protect your rivers,
Protect your mountains"

Emperor Yu of China
1600 BC



Agriculture

Potential Impacts to Riparian Areas
1. Sedimentation 2. Polluted return flows 3. Altered hydrology 4. Riparian vegetation clearing 5. Channelization

Agriculture BMP
1. Crop residue management 2. Proper fertilizer management 3. Integrated pest management 4. Proper irrigation management 5. Riparian buffer strips

Agricultural practices can strongly impact streams and riparian areas when proper management practices are not used (Binford and Buchenau 1993). Poor crop residue management and inefficient irrigation practices can contribute significant amounts of nutrients and sediment to streams. Altered hydrology due to irrigation diversions, stress riparian vegetation making it less capable of stabilizing streambanks (Briggs 1996). Another significant impact occurs where riparian areas are cleared to allow for more arable land. This removes vegetation that protects the land from erosion and reduces the natural filtering capabilities (Cooper et al. 1987). Channel straightening along cultural boundaries such as field borders often causes headcutting within the channel, lowers the water table, and increases sediment loads downstream.

Proper Agricultural Management

A comprehensive analysis of farming operations should be completed to identify where BMP systems are needed and how they will protect riparian areas.

Crop residue management which increases infiltration and minimizes runoff should be encouraged, such as no or low-till cultivation practices (Harpstead et al. 1988).

Wise and efficient use of water is a key component of an effective conservation plan. Crops and soil should be carefully monitored to prevent excessive water application which will minimize runoff. Conserved water may be used to enhance a riparian area, which will promote higher base flows later in the summer (Stabler 1985).

A soil analysis should be completed to determine the proper timing and amount of fertilizer needed. Also, through better irrigation management, less fertilizer is generally required, resulting in cost savings (Harpstead et al. 1988).

Integrated pest management involves monitoring pests to determine optimum pesticide timing, use of alternative pesticides, and use of biological controls. Proper management reduces the potential for excess chemicals to leave the field and enter nearby streams.

A riparian buffer strip is an area of riparian vegetation that has been managed to provide the many functions and benefits of these habitats (Shultz 1994). Riparian buffer strips generally consist of woody and herbaceous vegetation, that occur or are planted along the stream.

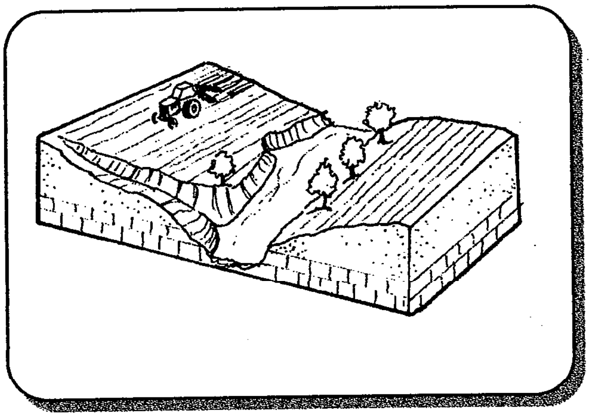
Diverse buffer strips containing a mixture of woody species such as willows, forbs, grasses, and grass-like species will often serve as effective filters of surface and subsurface water flows (Shultz 1994). It should be noted that in some areas, buffer strips with only herbaceous vegetation may be appropriate, i.e., where natural communities are dominated by sedges. Regional classification systems of riparian and wetland sites should be consulted such as *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen et al. 1995), *Riparian Community Type Classification of Utah and Southeastern Idaho* (Padgett et al. 1989), and others.

In many degraded areas, the natural plant community may have been eliminated and may need to be replanted. Regional classification systems and riparian vegetation specialists will be able to help you to determine which species are appropriate for your area.

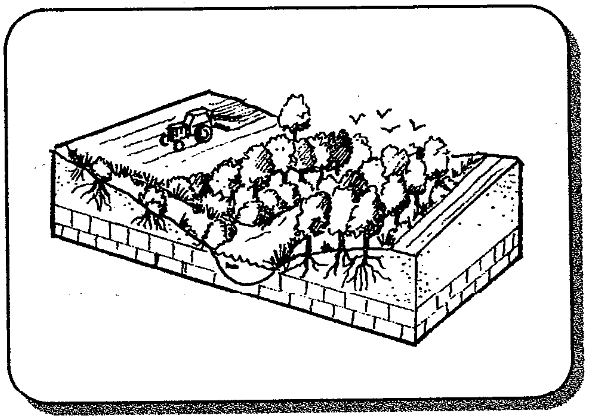
The width of riparian buffers varies depending upon soils, climate, vegetation, landuse, nutrient and sediment load, and the wildlife or fish species being managed for. Presently, research is being done on buffer widths in different parts of the country. However, at this time only estimates are available. In areas where the riparian area is intact, the width of the buffer should be at least the width of the existing riparian area and could possibly include an adjacent, small upland buffer. In areas where buffer strips are being created, a general rule-of-thumb is that buffer strips should be 2 to 5 times the width of the stream (Firehock and Doherty 1995). In general, a buffer should become wider as the stream increases in width and flow.

It should be kept in mind that other BMPs should be used in concert to avoid overloading the capabilities of the riparian buffer strip.

Check with your local NRCS District Conservationist for assistance and additional information on BMPs and cost-share programs for implementing conservation plans.



Without Protection and Management



With Protection and Management

Livestock Grazing

Potential Impacts to Riparian Areas

1. Sedimentation
2. Nutrient-laden runoff
3. Overgrazed vegetation
4. Riparian vegetation trampling
5. Bank destabilization

Grazing BMP

1. Fenced riparian buffers
2. Prescribed grazing management
3. Alternative water sources
4. Other structural improvements

Since livestock are naturally drawn to riparian areas in the West, improper grazing management has resulted in a major impact to streams and riparian areas in the region (Briggs 1996; Johnson and Jones 1977; Platts and Nelson 1985; West 1995).

Overgrazing of riparian vegetation results in streambanks being more vulnerable to the effects of livestock trampling and to the erosive force of water. Reduced vegetation exposes soils to drying by wind and sunlight, reduces water storage capacity, accelerates runoff, and reduces infiltration (Cannon and Knopf 1984; Kauffman and Krueger 1984). Overgrazing also encourages the invasion of weedy species and reduces shade and thereby increases water temperature (West 1995).

Overgrazing uplands may also impact the health of the stream even if the riparian area is protected. Overgrazed uplands can contribute higher sediment and runoff quantities than properly grazed uplands (West 1995). Consequently, it is not a matter of better grazing management for riparian areas, but rather a holistic grazing plan for all areas. The goal should be a grazing system that protects riparian areas while improving long-term financial return. Restoring degraded riparian areas may create new sources of income such as fees collected from hunters and other outdoor recreationists (West 1995).

Proper Grazing Management

Where riparian habitat is severely degraded, complete rest is more effective and quicker than trying to manage grazing during the first few years (Cannon and Knopf 1984; Platts and Wagstaff 1984).

Fencing the riparian area (and possibly some adjacent upland) to control livestock and wildlife access is one of the most effective ways to accomplish this goal. Research has shown that riparian habitat often improves quickly when fenced to exclude grazing or to control the time and duration of grazing. This applies to wildlife as well as livestock. Duff (1980) reported that riparian habitat grazed all season long remained in poor condition while adjacent ungrazed riparian habitat attained good condition within 4 years. Another study showed that a reach of Horton Creek in Idaho, which was overgrazed by sheep, was 4 times wider and only 1/5 as deep as an adjacent but fenced stream reach (Platts 1981). Some research, however, has shown that riparian recovery may not be quick if the riparian system is severely degraded (Clary et al. 1996; Clary 1995).

One of the most daunting aspects of fence construction is the labor required. Volunteer labor for riparian fence construction has been used successfully on both private and public lands (West 1995). Managers should investigate the opportunity of using volunteers such as Fish and Game volunteers and NRCS Earth Team members.

When installing fences, managers should resist the temptation to put fences at the high water line. The fenced areas should include enough land to restore riparian and stream function and allow the stream to shift naturally over time. In addition, upland areas included in riparian pastures can decrease livestock impacts by providing more acreage for the livestock to use especially during the spring grazing season. A monitoring program should be established to determine when the riparian area has healed sufficiently to allow grazing. In some cases, it may be desirable not to graze riparian areas in the long run because of the benefits a healthy riparian areas will return to the overall operation (Platts and Wagstaff 1984). For example, a ungrazed riparian zone may sustain higher base flows later into the summer (Stabler 1985; West 1995).

The foundation of any prescribed grazing program is a documented plan with identified goals and objectives. The key components of this management plan should address timing, intensity, and duration of grazing (Chaney et al. 1993; West 1995). Several grazing strategies incorporate these and other factors to minimize impact on streams and riparian areas (Chaney et al. 1993; Platts 1990). Many of these strategies are based on avoiding riparian areas when soils are saturated and susceptible to compaction and bank collapse. Some plans are based on rotating livestock from one pasture to the next during the year. A key component of successful grazing plans is carefully planned pastures which can be given rest from livestock grazing during a critical time. By having riparian areas fenced in separate pastures from the uplands, grazing can be carefully controlled.

Another strategy is to minimize the time livestock spend in riparian areas by creating desirable conditions in upland areas (West 1995). These include structural measures such as water facilities and shelters. Providing water in uplands can assist in luring livestock away from riparian areas. Shelters or shade which provide protection from the elements should also be placed in strategic upland locations. Using salting locations in uplands may assist in drawing livestock from riparian habitats. Improving upland forage desirability through seeding and other techniques may also be incorporated in the management plan.

Range conservationists that understand riparian areas and livestock management should be consulted in preparing a grazing management plan to improve the entire operation and associated ecosystems.

Geyer Willow
Salix geyeriana

Timber Production

Potential Impacts to Riparian Areas

1. Sedimentation
2. Stream crossings
3. Riparian vegetation clearing
4. Increased runoff

Forestry BMP

1. Riparian buffers
2. Proper roadway design
3. Proper stream crossings
4. Sustainable logging strategies

Although, timber harvesting activities usually occur in upland areas, logging practices can significantly impact streams and riparian areas (Firehock & Doherty 1995). Poorly designed and constructed access roads contribute large quantities of sediment to streams. Because riparian valleys usually have a flatter gradient than upland areas, roads are commonly aligned along streams, resulting in the clearing of riparian vegetation and other impacts. Timber harvesting methods that significantly reduce vegetation such as clear cutting, can contribute to higher sediment and runoff quantities. It can also increase peak flows due to lack of canopy allowing snowpack to melt quicker.

Proper Forestry Management

BMPs are available to reduce the impact of timber harvesting (Seyedbagheri 1996). Every few years, national forests must prepare a forest management plan which addresses the forestry practices in use. These plans are available for public review and comment. In addition, several states have forest practices acts which influence timber harvest practices in that state. Through existing laws and public participation in the planning process, BMPs can be applied to timber harvesting activities.

Riparian buffers, which were covered under the earlier sections, should be applied in all timber harvest locations. Essentially, the buffer should be as wide as the natural riparian area and should include some upland area. This should not be a problem because many riparian tree species have low economic value to the timber industry.

New access roads should be designed to avoid riparian areas. Although construction costs may be initially higher, lower maintenance should provide cost savings in the long run. Stream crossings should be avoided whenever possible.

When stream crossings are inevitable, new crossing designs are available to minimize impact. Refer to the *Riparian Road Guide* in the Resource section for ideas. This guide also provides valuable ideas on retrofitting existing roads with better stream crossing designs. In some cases, it may be appropriate to restore existing roads back to natural conditions.

Finally, the actual logging practice should be examined to see how timber can be harvested in a manner that protects all of the forest resources. A forester should assist with development of an appropriate logging strategy.

Potential Impacts to Riparian Areas

1. Polluted runoff
2. Increased runoff
3. Clearing of riparian vegetation
4. Riparian vegetation trampling
5. Channelization

Urbanization BMP

1. Avoidance of riparian areas
2. Riparian buffers
3. Reduce impervious cover
4. Limit disturbance and erosion of soils
5. Treat stormwater runoff

Urbanization has often resulted in serious impacts on streams and riparian areas (Binford and Buchenau 1993). In recent history, streams were considered a problem rather than an asset in communities. Consequently, streams were often channelized to reduce flooding and offered a means of getting rid of sewage. Ironically, these practices increased flooding and associated problems for all of the communities in the watershed.

Impervious surfaces such as massive parking lots increase runoff and flush pollutants into streams (Schueler 1995). In urbanizing areas, riparian vegetation is often cleared away for construction. Even in cases where some areas are protected from development, heavy recreational use has resulted in trampled riparian vegetation (Cole 1993).

Although a majority of the Great Basin and Intermountain West is rural, many urbanizing communities in the region already have impacted streams and riparian areas. Restoration of these habitats should be considered for the benefit of the community and the environment (Briggs 1996). Because rapid growth is beginning to occur in the region, growing communities should take a pro-active role in protecting their riparian resources.

Urban Land Use Management

Protection of stream and riparian areas in urbanizing environments is a holistic process that must encompass the whole range of the development sequence (Schueler 1995). Communities cannot rely on one BMP to protect their riparian areas.

The first step is to inventory streams and riparian areas in the community. This includes ephemeral streams that may only flow intermittently. These habitats still play a significant role in the arid West and should be protected from development by narrow buffers. Protection can occur in a variety of ways such as land acquisition or conservation easements.

A stream buffer system should be considered in communities (Herson-Jones et al. 1995). In some communities, a three level buffer system have been effective where different uses are allowed in each zone. For example, the first buffer zone adjacent to the stream could be primarily for natural functions to occur and would not allow many uses. The second zone placed farther back from the stream could allow some recreational uses such as pathways. The third zone, farthest away from the stream, would allow more uses.

When this three-level approach is not applied, many buffers become an extension of the adjacent landowner's yard. When these areas are treated as lawns, the benefits of the buffer are greatly diminished (Schueler 1995).

Impervious cover alters the natural hydrology of an area. Runoff is quickly conveyed to streams which results in higher peak flows and reduces the dry season base flows. Impervious cover in communities consists of everything from rooftops and sidewalks to parking lots. Some research shows that stream and riparian degradation occurs at relatively low levels of imperviousness from 10 to 20% per unit area of land (Schueler 1995).

Two main approaches can be used to deal with impervious cover. First, stormwater drainage should be shifted to infiltration and dispersal methods rather than allow runoff to concentrate. Impervious cover should be connected to infiltration trenches and recharge basins rather than piping it to a discharge point along a stream.

Second, the amount of impervious cover in a community should be reduced. This will require creative design and cooperation among designers, developers, and city officials. Methods to reduce impervious cover include zoning measures, realistic street and parking lot design requirements, use of porous paving materials, cluster development, and shared parking facilities.

To illustrate the cooperative nature of this endeavor, an example is a bank which is not open on Sundays, allows an adjacent church to use the parking facilities.

Communities should consider limiting disturbance and erosion of soils during construction. The timing and amount of ground that can be exposed at a given time can be controlled to minimize erosion. Effective erosion and sediment BMPs can also be applied. The International Erosion Control Association can offer guidance in this area (see Resource section).

After these measures have been applied, it may still be necessary to treat stormwater before it enters the riparian area. Stormwater treatment systems that allow for natural infiltration and recharge into the aquifer after treatment are a good option in our arid environment. Other worthwhile treatment systems include constructed wetlands, vegetated swales, and filter strips.

Urban stream and riparian protection is a complex and interrelated process that requires the involvement of professionals, city officials, and the community. Most importantly, it must be supported by the community at large.

A particularly good resource for this process is the book, *Site Planning for Urban Stream Protection* by Schueler (1995) which can be found in the Resource section of this guide.

Stream and riparian degradation often occurs when impervious cover reaches 10-20% in a watershed.

(Schueler 1995)

A RESTORATION TOOL: BEAVER

The use of beaver to restore riparian areas and recharge waters in rangelands and other areas is an excellent example of using natural processes (West 1995). Some believe beaver are the reason for riparian destruction. If this were the case, beaver would have eliminated every streamside tree in North America prior to European settlement. Obviously, this did not happen. Riparian areas developed with beaver and they are part of the natural dynamic equilibrium.

The dam-building behavior of beaver makes them effective riparian managers. Their dams trap sediment and pond water. This raises the local water table and slows down the overall velocity of the stream. In some areas, beaver have helped maintain year-round flow, even during periods of drought. More water is then available for livestock and wildlife. Because ponding raises the water table, a lush riparian area will often develop, which benefits livestock and wildlife. Beaver ponds also store spring runoff, often reducing the effects of seasonal downstream flooding.

Areas chosen for beaver reintroductions should have perennial flows no less than 0.5 cfs, channel slopes 3 percent or less, and adequate woody vegetation for food and construction material (West 1995). Large rivers, (4th order and higher) are probably not appropriate for beaver reintroductions. In some areas, it may be necessary to allow the woody vegetation to recover before bringing in beaver.

After beaver have been reintroduced, the new colony needs to be protected for the first 3 years while becoming established. After this time, some beaver should be harvested because natural predators are no longer as abundant as historically.

Those interested in reintroducing beaver should contact their state fish and game agency.